Although *Littorella uniflora,* the European species has not been studied, descriptions of its leaves as, "subterete or semi-cylindric" indicates a similarity to those of *L. americana.* Otherwise, in floral structures and size Minesota plants well agree with Fernald's descriptions. The purplish-black fruit in maturity appears terete, apiculate with a short stipe and a minutely rugose pericarp.

Plants collected in late October show yellowing and gradual decay of the older leaves. Under greenhouse conditions the young leaves continue growth. The renewed overwintering rhizome of the season is 2–3 mm. thick and about as long; rhizomes of the previous years are persistent, subject to gradual decay. Whether the plants are stranded or submersed, they are readily recognized in field studies. The terete-appearing leaves, 1–2.2 mm. thick near the midpoint cannot be confused with *Ranunculus repens.*[2] Their outwardly-arching habit sets them apart from the linear-compressed obtuse leaves of *Lobelia Dortmanna,* which are broadly elliptic in cross-section, with two lacunae flanking the median trace.

The author is indebted to the Quetico-Superior Wilderness Research Center for courtesies pertinent to facilities for field studies, the Graduate School of University of Minnesota for defraying the cost of collecting and Dr. J. B. Carlson and Donald W. Davidson, Duluth Branch, for preparing the illustrations.—
UNIVERSITY OF MINNESOTA, DULUTH BRANCH.

EXPERIMENTS AND OBSERVATIONS BEARING ON EVOLUTION IN OENOTHERA

R. Ruggles Gates[1]

I

During an examination of the collections of *Oenothera* in the Gray Herbarium, Harvard University (Gates, 1957), a new species *Oe. perangusta* (Gates, 1950) was described from the North shore of Lake Superior. One specimen in the collection from Jackfish Station differed from the rest in having deep red stems and buds. It was recognized as a mutation parallel to the red-budded mutation from *Oe. Lamarckiana* (Gates, 1911)

[1] Cambridge, Mass.

and was therefore called *Oe. perangusta* var. *rubricalyx*. While in Vancouver, B. C., in 1953 I found in the herbarium of the University of British Columbia, through the courtesy of Professor Hutchinson, specimens of the same species and its red-budded variety originally collected from the same locality. On my way East I was able to stop at Jackfish, and had the good fortune to find the original locality from which the red-budded mutation was derived.

About 1400 feet east of Jackfish Station on August 28, 1953 near the railway, a colony of *Oenothera* was found in which were counted 7 plants with red stalks in fruit and many young rosettes also evidently of the red variety (as shown by the red colour ventrally of the midribs), as well as one plant of the ordinary type with green stems. A specimen was collected for the Gray Herbarium. The red plants in this clump must all have been descended from the original mutation. How old this colony is can only be conjectured, but Mr. Peter Leschuk, who managed the local hotel and afterwards sent me seeds on Sept. 28 when they were ripe, thought he remembered seeing the red form here as a boy. The clump might easily be destroyed by railway operations. Search of the area failed to reveal more than the one group of red plants.

In June, 1954, returning from Japan over the same route, many observations of *Oe. perangusta* were made. The species was very uniform all along the north coast of Lake Superior from Schreiber Station, where there were large colonies, to Terrance Bay, near Angler Station, at Marathon and along the C.P.R. line to Heron Bay. At the last locality were large numbers of plants in their favorite habitat, loose sand and gravel on the steep railway embankment some 400 yards west of the station. Nowhere were red plants seen except in the clump near Jackfish Station. The same species was afterwards seen growing by the railway near Hamilton, Ont. It thus evidently occupies a wide area in Ontario, from the north shore of Lake Superior to Hamilton on Lake Ontario and the Bruce Peninsula (Gates, 1950) of Lake Huron.

II

All the small-flowered Oenotheras, including nearly all the species in Canada, are self-pollinating. There is clear evidence, however, that cross pollination occasionally occurs between different forms occupying the same area. Such crosses are an important factor in the evolution of the genus, and it is therefore desirable to obtain some evidence of the frequency with which cross pollination takes place in nature. For this purpose the ideal would be to use *Oe. perangusta* and its dominant red mutation, planting them in alternate rows and collecting open-pollinated seeds from the green form. Any plant with red buds derived from these seeds would then be the result of cross-pollination.

Before seeds of *Oe. perangusta* and its red form were available, this experiment was tried with *Oe. Victorini*, a species with somewhat larger flowers which may be somewhat less strictly self-pollinating. Seeds of *Oe. Victorini* were obtained from the Montreal Botanical Garden through the Director, Professor Jacques Rousseau, and of a strain of *Oe. blandina* containing the gene (*rubricalyx*) for red buds from Professor D. G. Catcheside. These were grown at the Bussey Institution, Jamaica Plain, Mass., the facilities being kindly provided by Professor Karl Sax of Harvard University. The two species were planted in four alternate rows, ten plants to each row. When the seeds were collected on September 15, 1953, only nine plants of *Oe. blandina rubricalyx* had flowered, mostly from side branches. They also came into flower later than *Oe. Victorini.* The 20 plants of this latter species all flowered and were full of seeds, many of the capsules having already shed some of their seeds. Since the species with red buds began flowering later, only the later seed capsules of *Oe. Victorini* were collected, four capsules from each of 12 plants.

As a partial control of the frequency of crossing, the number of capsules on 12 plants of *Oe. Victorini* was roughly estimated. They totalled 2305, with a range from 100 to 385 per plant. Estimating 300 seeds per capsule, a total of 691,500 seeds could have been exposed to "red" pollen in time to ripen before the frosts. It was judged that 10 lower capsules per *Victorini* plant or 36,000 seeds, were fertilized before the *blandina* pollen began to be produced. Subtracting this number leaves 555,500 seeds probably exposed to "red" pollen.

About four capsules each from eleven exposed *Victorini* plants were sown on vermiculite in the greenhouses of the Bussey Institution on Ooctober 2, 1953. On January 16, 1954, they had produced 3395 young rosettes, two of which had ventrally red midribs and would therefore have red buds. This gives a very tentative crossing frequency of 1:1698. Later attempts to get results on a large scale, using *Oe. perangusta* and its red variety, have not succeeded because the plants remained rosettes which failed to survive the winter season.

III

One incidental observation is worth recording. *Oenothera* flowers are generally visited by nocturnal moths after the flowers open in the evening. Their long proboscis enables them to suck up the nectar which is secreted in the hypanthium and fills the lower part of this tube. Bees may also be seen visiting *Oenothera* flowers. One bee which was carefully observed visited flower after flower in a routine way. Being unable to obtain the nectar at the base of the hypanthium in the normal way by sucking it up from the inside, it lighted on a petal, then walked down the slender hypanthium, punctured it at the base just above the ovary, and lapped up the nectar, leaving an ooze of nectar where its short proboscis had been withdrawn. The pollination mechanism was thus entirely bypassed, the bee obtaining the nectar without entering the flower. This was done with flower after flower on different plants as a regular routine. Whether this bee was exceptional in having discovered a way to circumvent the floral mechanism, or whether this is a general custom of bees in the New England area or elsewhere is unknown. It shows at any rate that some bees have developed an efficient method of their own for extracting the nectar from *Oenothera* flowers. The fact that each flower is punctured in the position to obtain the maximum amount of nectar from the nearly erect hypanthium, seems to show a mental activity closely akin to intelligence.

Literature Cited

Gates, R. R. 1911. Studies on the variability and heritability of pigmentation in Oenothera. Zeits. f. Abst. u. Vererb. **4:** 337–372.

———— 1950. Another parallel mutation in Oenothera. Canad. Field-Naturalist **64:** 142–145.

———— 1957. A conspectus of the genus Oenothera in North America. Rhodora. **57:** 9–17.